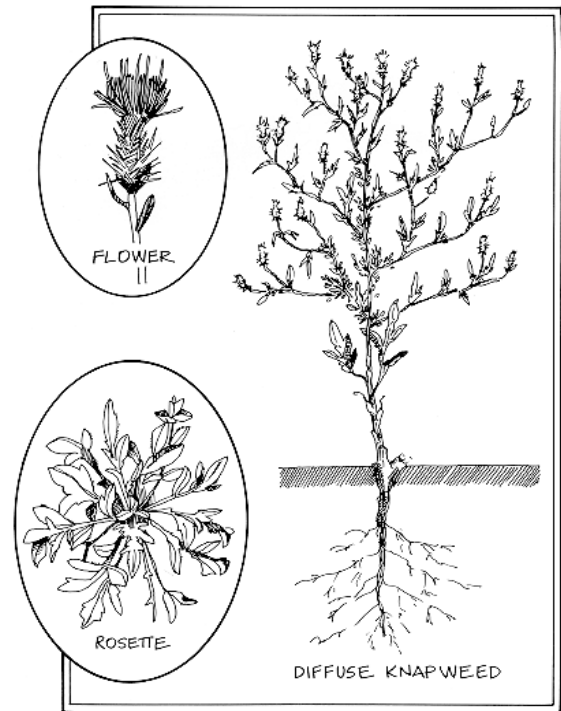


KNAPWEED INFORMATION PAGE

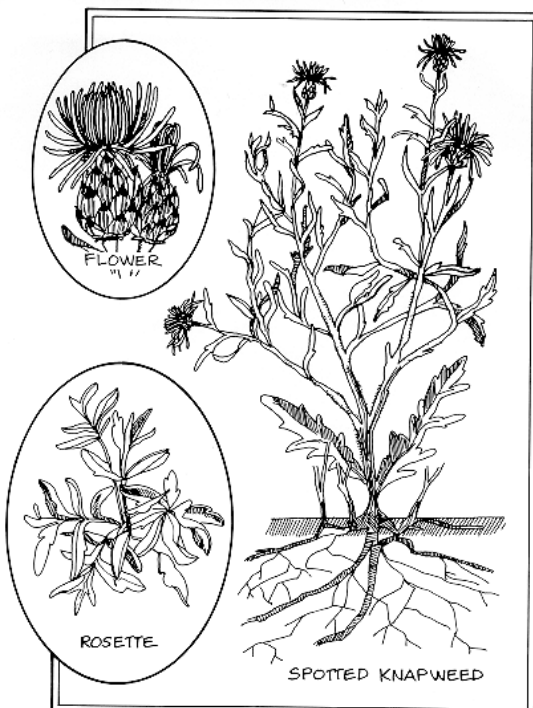
Centaurea diffusa, *Centaurea virgata*, and *Centaurea maculosa*

DIFFUSE Knapweed (*Centaurea diffusa*): Most plants of this species live to be two to six years old and are capable of spreading only by seed. One hundred plants per acre can produce more than one million seeds on dry rangeland. Seeds of this plant have been shown to remain viable in soil for at least 12 years. During the first year of growth, after the seeds germinate, the plant takes on the form of a small cluster of gray-green, lobed leaves that lay close to the ground (in botanical terms, this is called the basal rosette). During the second year, the basal rosette produces a densely branched, leafy stem. At the ends of most branches, a number of small flowers are produced. They are wrapped in a cluster of small, reflexed, and spiny bracts (this entire structure of bracts and flowers is called the flowering head). Each flower within the flowering head produces a single, small seed at the top of which are attached numerous, what appear to be short, coarse hairs. The plants grow most actively from April to October, flowers are produced from June until September, and the seeds set from July to October.



Squarrose Knapweed (*Centaurea virgata*):

Squarrose knapweed is a competitive rangeland weed that is often confused for diffuse knapweed. Unlike diffuse knapweed, however, squarrose knapweed is a true perennial, and its bracts are recurved, which means that they point down towards the ground. Diffuse knapweed bracts are reflexed and point straight out from the flower head. The seed heads of squarrose knapweed are also highly deciduous and fall to the ground soon after the seeds mature, a trait uncommon to diffuse knapweed. A member of the sunflower family, squarrose knapweed is long-lived and can grow to heights of 12-18 inches. It is also known for its stout taproot. Stems are highly branched, with deeply dissected lower leaves and bract-like upper leaves. The lower leaves often wither by the time the plant flowers. Flower heads are relatively small, are borne singly or in pairs at



the tops of the branches, and contain four to eight rose or pink colored flowers. The flower heads are smaller than other knapweeds in the western United States, $\frac{1}{4}$ to $\frac{3}{8}$ of an inch long and $\frac{3}{16}$ of an inch wide. Bract tips are recurved or spreading, with the terminal spine being longer and stouter than the lateral spines on each bract. Squarrose knapweed produces no more than three to four seeds, and empty seedheads are common. The seeds are golden to dark brown with faint linear stripes and an oblique scar where they detach from the head. Seeds remain inside the protective cover of the heads when they fall to the ground. The plant is fully adept at surviving in drought conditions and in extreme temperatures, and it does not rely on seed production or the success of seedlings to maintain its populations. Rosettes may grow slowly over a long period of time until conditions suit the plant for flowering.

SPOTTED Knapweed (*Centaurea maculosa*):

Spotted knapweed is a perennial, rosette-forming plant with a deep taproot. It can have one or more stems, and can grow

between eight inches and three feet tall. Spotted knapweed stems divide on the upper half of the plant, leading to solitary flower heads at the end of the branches. Stem leaves are alternate, have few lobes, and are smaller towards the stem apex. Flowers are purple or pink, with about 25 to 35 flowers per head, and they bloom from June to October. Involucre bracts beneath the flowers are leaf-like, egg-shaped, and are tipped with a dark, comb-like fringe. These bracts are widest at the base and are yellow-green on the top and brown below. The fruits of spotted knapweed are 1/8 of an inch long, oval, brown to black, with pale longitudinal lines. A tuft of persistent bristles crowns the tip of the seed. Spotted knapweed will form a rosette in the first year with the flowering stalk being produced in the second. Rosette leaves are deeply divided into lobes on both sides of the center vein and have an oblong shape.

Flagstaff Localities:

Diffuse knapweed was first introduced to the Pacific Northwest at the turn of the century as a contaminant in alfalfa seed imported from Europe. The first collection of this plant in Arizona was made August 5, 1979 along Hwy 89, seven miles north of Flagstaff near Black Mountain Homes. It now dominates the landscape along Industrial Blvd. east of Steves Blvd, the open, disturbed fields in the vicinity of the Country Club exit off of I-40, considerable acreage north and east of the Flagstaff Mall, and numerous smaller areas around schools, public playgrounds and parks.

Squarrose knapweed is a native of Bulgaria, Lebanon, northern Iraq, Iran, Afghanistan, and Turkestan. A sheep rancher between 1934 and 1937 first noted it in the United States, and it was later collected in Big Valley, California in 1950. Utah collected squarrose knapweed from Tintic Junction in 1954. As of 1988, both states have infestations of over 20,000 hectares. Oregon and Arizona (north of the Grand Canyon) have now reported small populations of the weed and control efforts are being made to stop the spread of squarrose knapweed before it establishes itself and spreads.

Spotted knapweed was introduced into the United States in the late 1800's as a contaminant in alfalfa and also through discarded soil used as ship ballast. The weed was limited to the San Juan Islands, Washington until 1920. Unfortunately, control methods were not able to contain the pest and by 1997 it could be found in 14 western states, and in every county in Washington, Idaho, Montana, and Wyoming. Spotted knapweed infestations can be found in various places throughout northern Arizona, including Diversion Park, A-1 Mountain, and within Switzer Canyon.

Economic Impact:

If we continue to allow these knapweed species to spread unabated, they will soon be the dominant vegetation in vacant lots and waste/construction areas in our city. As more and more people come into contact with these prickly plants, they will continue to spread into open spaces in Flagstaff (parks and along the urban trail), pasture lands, and along trails into our national forests. Once in the forest, knapweed has shown us that it will not simply stay along trails. Many national forests in Montana and Idaho have thousands of infested acres where knapweed has been able to out compete native plants. In many places it effectively crowds everything else out. Because these species of knapweed are not readily edible to our local wildlife, the encroachment of these plants will have pronounced effects on native antelope, deer, elk, rodents, and birds and grazing livestock by severely restricting their habitat. Knapweeds growing along streams and watersheds increase erosion and damage aquatic life. The United States government estimates that noxious weeds, predominantly knapweeds, consume 4,600 acres of public land each day. In Union County, Oregon, it has been estimated that 100 acres of public forest and grazing lands are overrun by knapweed every 24 hours.

Control:

An integrated combination of methods will be needed to successfully control such aggressive and adaptable weeds. Prevention and detection of new populations, as well as eradication and containment of existing populations all need to be addressed to achieve control over the various species of knapweed.

Cultural Control:

Prevention is the most effective and least expensive method of control. Do not drive through areas infested by knapweed. Check vehicles for attached knapweed plants in tires and grills when leaving an infested area. Do not purchase hay that is infested with knapweed seeds. Practice sound pasture management to prevent overgrazing. Reseed disturbed sites with vigorous, hardy, native plants in order to deter the establishment of knapweed seedlings. Detecting and eradicating weed introductions early, minimizing soil disturbance, and containing neighboring knapweed infestations can also limit knapweed spread.

Mechanical Control:

Hand pulling or grubbing knapweed is most effective on small infestations, perimeter populations, along riparian zones, or following an herbicide treatment. Pull small patches before the plant goes to seed. Seed any disturbed area with perennial grass or grass-legume cover. If the plant's life cycle is considered, burning could be an under-utilized tool to control knapweed infestations in the Flagstaff area. In a study done in Utah, burning as well as herbicidal treatments controlled a population of squarrose knapweed up to 97%.

Chemical Control *(Noted here are chemical control techniques that have been used in other areas. Always check with weed specialists or chemical suppliers before treatment to ensure correct dosage and application. Mention of these products does not imply endorsement by the Northern Arizona Weed Council or The Nature Conservancy.):*

Diffuse knapweed can be controlled by using Transline™ if it is sprayed early in the season. It is better than Tordon™ because it is not a groundwater contaminant and will not kill trees. This chemical, however, may be 2 to 3 times more expensive than Tordon™. Some agencies recommend applying a combination of either Banvel™ or Tordon™ with 2,4-D, or a combination of Banvel™ and Tordon™ in order to lessen the effects on native grasses.

Squarrose knapweed was controlled in Utah after a burn with Tordon™ mixed with 2,4-D. 2,4-D alone did not provide satisfactory control of squarrose knapweed. Dicamba (Banvel™) is also effective.

Spotted knapweed is effectively controlled on rangelands with picloram, clopyralid, dicamba, and 2,4-D. In one study, picloram provided nearly 100% spotted knapweed control for three to five years. Clopyralid plus 2,4-D provided control similar to picloram when applied during bolt or bud growth stages. Percent control dropped to below 83% when this herbicide combination was applied at rosette, flowering, and after flowering growth stages.

Biological Control *(No exotic species should be introduced into an ecosystem without extensive research into the long-term effects. Mention of the species below does not imply appropriateness for use in Northern Arizona.):*

There have been a number of introduced insect species that have been imported for the control of knapweeds in North America. Most of these biological control agents attack the flower head with the goal of reducing seed production and plant spread. Biological control is most appropriate in populations large enough to be beyond control by any other means.

Note: No single control method, or any one-year treatment program, will ever achieve effective control of an area contaminated with knapweed. The fast growth, high seed viability, fast rate of spread, and long seed dormancy of this plant require long-term cooperative integrated management programs and planning to prevent, contain, and reduce knapweed infestations.

Moser, L; D. Crisp. San Francisco Peaks Weed Management Area fact sheet on Knapweed. Coconino National Forest.